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June 15, 2001

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BY HAND DELIVERY

Donald Abelson, Chief
International Bureau
Federal Communications Commission
Washington, D.C. 20554

David Solomon, Chief
Enforcement Bureau
Federal Communications Commission
Washington, D.C. 20554

Bruce Franca, Acting Chief
Office of Engineering and Technology
Federal Communications Commission
Washington, D.C. 20554

Re: Harmful Interference to Licensed VSAT Operations

Dear Messrs Abelson, Solomon and Franca:

On behalf of Spacenet Inc. ("Spacenet"), a wholly-owned subsidiary of Gilat Satellite Networks, Ltd., and at the suggestion of the Commission's staff, we are submitting for your consideration a proposal to address harmful interference that unlicensed Part 15 receivers are causing to licensed Ku and Ka band VSAT operations.[1] Spacenet recently received the letter dated June 1, 2000, submitted by counsel for Safety Radar Systems on behalf of several radar detector manufacturers. We note that contrary to the tenor of that letter, we have provided detailed technical information regarding VSAT antennas to the radar detector manufacturers. We are looking into their technical proposals, but we cannot subscribe to the condition that the FCC forbear from any rulemaking that might affect them. The decision whether to institute a rule making proceeding is within the sound discretion of the FCC and not a matter for agreements between and among private parties.

[1] Spacenet became aware of this issue in connection with its Ku-band operations. Because earth station receivers in the Ka band operate with very weak incoming signals just as Ku-band receivers do, we believe that the discussion is relevant to that band as well.

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In December 2000, Spacenet shared technical data with the Enforcement Bureau, the Office of Engineering and Technology and the International Bureau. The technical data demonstrated that radar detectors were the likely source of harmful interference to licensed VSAT operations in the Ku and Ka bands. At the request of the Enforcement Bureau and the Office of Engineering and Technology, the FCC's Laboratory conducted independent testing of various radar detector models. The FCC Laboratory's test results demonstrated that the radar detectors generate very high levels of unintentional emissions, with field strengths exceeding the Part 15 emission limits by 36 to 56 dB. These emission levels are more than sufficient to cause interference to the operation of licensed Ku band VSAT stations when the radar detectors are near a VSAT facility. The Laboratory further concluded that the level of emissions is so high as to call into question whether the radar detectors are designed in accordance with sound engineering practices.[2]

The Office of Engineering Technology, together with the International Bureau, also placed some random telephone calls to various licensed VSAT operators to determine whether they have experienced harmful interference from unlicensed devices. This exercise uncovered two technical studies, one prepared by Telesat Canada, entitled "Radio Frequency Interference from Police Speed Radar Detectors," and the second prepared by Bell Laboratories, entitled "Radar Detector Interference—Characteristics and Recommendations." The results of both technical studies corroborate the FCC Laboratory testing and the Spacenet technical study.

Spacenet welcomes the cooperation of the FCC staff in performing the corroborating testing and successfully obtaining the cooperation of other independent parties with supporting technical studies. It is now evident that the unintentional emissions from many current radar detectors are incompatible with licensed VSAT operations in the Ku and Ka bands. The nature of the interference caused by these unlicensed devices is especially pernicious because radar detectors are used by consumers in their cars, making it virtually impossible to predict when or where the harmful interference will occur.[3]

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[2] Spacenet understands that the FCC Laboratory tested the various radar detector models by applying the frequency measurements for unintentional radiators specified in Section 15.109 of the Commission's Rules.

[3] Based on Spacenet's study of the radar detectors that have caused among the highest levels of harmful interference to licensed VSAT operations, Spacenet believes that design modifications to the radar detectors could further reduce harmful levels of unintentional emissions. For example, better shielding of the radar detector oscillator as well as further isolation of the oscillator mixer could reduce unintentional emissions.

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As the Commission is aware, the VSAT industry is a notable success story in the satellite industry, providing businesses with a wide variety of information services essential to their efficient operations. VSAT customers are dependent on the availability of reliable service. The type of harmful interference that radar detectors generate directly affects the reliability and the service quality of all VSAT service providers, thereby threatening the viability of continued service.

Given the unique service that VSAT networks offer, including the prospects of bringing broadband services to rural and unserved areas, it is important for the Commission to act in the public interest to protect its licensees from harmful interference caused by unlicensed devices. With embedded consumer use and existing inventories of the offending radar detectors, fashioning a workable strategy to address this serious issue is challenging, but not impossible. On an immediate basis, because of the extraordinarily high levels of emissions from the tested devices and the severity of the harm suffered by VSAT operators as a result of interference from radar detectors, the Commission should initiate enforcement action against the manufacturers to immediately stop the importation and sale of radar detectors that emit radiation in the satellite downlink bands.[4]

As a permanent solution, Spacenet asks the Commission to consider the following approach to eliminating, or at least materially reducing, the levels of interference received by VSAT stations from unlicensed receivers generating unintentional emissions in the Ku and Ka bands:

1. Amend Section 15.101(b) of the Commission's Rules, which limits equipment authorization requirements for receivers to those receivers that "operate (tune) within the frequency range of 30-960 MHz," by increasing the upper limit from 960 MHz to 40 GHz.[5]

2. Amend the radiated emission limits applicable to the downlink Ku and Ka bands to -154 dBm/100 kHz, measured in accordance with the testing procedures specified in Sections 15.109, 15.31, and 15.33.[6]

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[4] Where an unlicensed device is very likely to cause widespread harmful interference, the FCC has authority, pursuant to 47 U.S.C. § 302(a), to proceed in the public interest against the manufacturer to protect the integrity of licensed users. *See In the Matter of Rocky Mountain Radar, Application for Review*, Memorandum Opinion and Order, 12 FCC Rcd 22,453 (1997).

[5] Spacenet's interest is in protecting the viability of the satellite downlink Ku and Ka bands from interference caused by receivers that tune above 960 MHz. 40 GHz is the maximum upper frequency for Part 15 measurements of unintentional radiators, *see* Section 15.33(b)(1), which makes that frequency a logical upper limit for the operating or tuning range of receivers under Section 15.101(b) as well. Spacenet is not opposed to a different upper limit, if the Commission sees good reasons not to use 40 GHz, as long as it protects the downlink Ku and Ka bands.

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Our request is based on the following:

The amendment to Section 15.101(b) will subject the interfering unlicensed devices to an authorization requirement. This is necessary because the interfering devices themselves are widely dispersed in the hands of consumers, which makes the prevention of harmful interference to licensed operations through the individual equipment operators impracticable. Only by exerting regulatory control over the manufacturers of the unlicensed devices can the FCC protect VSAT licensees from this harmful interference.

Interference to VSATs ranges from momentary interruptions of the downlink bit stream, resulting in bit errors, to a total loss of synchronization or signal lock, resulting in complete interruption of message transactions. The severity of the impairment depends on the proximity of the radar detector to the VSAT antenna, the emission level of the radar detector in relation to the downlink signal from the satellite, and the emission frequency relative to the VSAT signal in question. The proposed limit for the emissions of unlicensed devices in the FSS downlink Ku and Ka bands was calculated according to the following analysis.

The carrier power of the desired satellite signal at the VSAT antenna input is calculated using the formula below:

Carrier Power at Antenna Input (dBW) = Satellite Saturated EIRP (dBW) - COPBO (dB) - Path Loss (dB)

Carrier Power at Antenna Input (dBW) = 50.0 dBW - 31.0 dB - 205.6 dB = -186.6 dBW or -156.6 dBm

Thus, typical signal levels at the input to the VSAT antenna are in the neighborhood of -156 dBm for a VSAT downlink signal that occupies a 100 kHz bandwidth. Spacenet's proposed Part 15 limit of -154 dBm/100kHz is calculated with reference to this level of desired signal at the input of the licensed VSAT antenna. The calculations assume that the emitting unlicensed device may be as close

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Footnote continued from previous page

[6] The radiated emissions standards are given in Section 15.109. That Section currently specifies a limit of 500 uV/m above 960 MHz for all devices other than Class A digital devices. Spacenet has specified the proposed limit in dBm, a common measurement unit at Ku and Ka band frequencies. While we believe that expressing the limit in common units makes sense, we have no objection to stating the limit in an equivalent form such as uV/m

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as 3 meters to the VSAT antenna[7] and that the link degradation due to the interference will not exceed 0.1 dB.

The analysis proceeds using the attached sample link budget for a typical Ku-band 64 kbps carrier received by a 1.2 meter VSAT antenna, the smallest Ku-band antenna routinely licensed under Part 25 of the FCC regulations. The link budget indicates that the total carrier-to-noise power spectral density per unit bandwidth ("C/No") for the link is 58.8 dB-Hz. This C/No corresponds to a carrier-to-noise ratio ("C/N") of 10.7 dB (using the symbol rate of 64 ksps to convert No to N). For a link degradation of 0.1 dB, the interference noise power must be 17 dB below the link noise. Therefore, the maximum interference emission level must be 27.7 dB below the carrier level at the earth station receiver.

Earth station antennas are routinely authorized for installation at elevation angles as low as five degrees.[8] Earth stations are also routinely licensed if their antenna off-axis receive gain complies with Section 25.209. At five degrees off axis this antenna gain is computed as:

Earth Station Antenna Gain (5°) = 29 - 25 Log (5°) = 11.5 dBi

A 1.2 meter Ku-band antenna has a nominal receive gain of 41.7 dBi (*see* attached link budget). Therefore, the earth station antenna will provide an off-axis isolation of 30.2 dB (41.7 dBi minus 11.5 dBi) between the desired signal and terrestrial interference signals. The interference power level at the input of the antenna is calculated using the formula below:

Interference at Antenna Input (dBm) =
Carrier Power at Antenna Input (dBm) - C/N Isolation Required (dB) + Antenna Gain Isolation (dB)

Interference at Antenna Input (dBm) = -156.6 dBm -27.7 dB + 30.2 dB = -154.1 dBm

Since the 64 kbps carrier with QPSK modulation and FEC = ½ occupies a 100 kHz bandwidth, the maximum interference power allowed for the 0.1 dB of link degradation is referenced to 100 kHz bandwidth. Therefore, the maximum allowable interference emission referenced at the input of the VSAT antenna is -154 dBm/100kHz.

The analytical use of the 64 kbps carrier with QPSK modulation, FEC = ½, an occupied bandwidth of 100 kHz, a C/N of 10 dB, and an allowable link degradation of 0.1 dB is consistent with

[7] Three meters is also the reference distance for Part 15 field strength limits. *See* Section 15.109(a).

[8] *See* Section 25.205.

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assumptions utilized in the extensive study performed by the European Telecommunications Standards Institute (ETSI) on this subject. The ETSI Technical Report ETR 077, *Satellite Earth Stations (SES): Spurious radiation limitations to and from satellite earth stations, Very Small Aperture Terminals (VSAT) and Television Receive Only*, provides the results of their investigation.

Measurement of radar detectors or other unlicensed devices may be made using commonly available test equipment such as spectrum analyzers and standard microwave gain horns, such as are currently used by the FCC in their evaluations of such devices. Interference signal levels can be stated in microvolts per meter, dBm, or milliwatts per square centimeter, so as to simplify measurements. Measurement frequencies for unlicensed scanning emitters should be specified to avoid interference in VSAT frequency downlink bands.

We recognize that these changes will result in some manufacturers of receivers operating above 960 MHz becoming subject to the Commission's equipment authorization rules for the first time. Nonetheless, we submit that regulating the manufacturer is the only way to minimize the harmful interference caused by radar detectors and similar devices. By requiring manufacturers to meet performance standards, the Commission will establish a direct route under Part 15 of the Rules for taking enforcement action against manufacturers of violating devices. With the Commission's recent streamlining of the entire equipment authorization process, we believe that this regulatory burden is minimal, and more than justified by the harm that can be caused to the licensed VSAT services.

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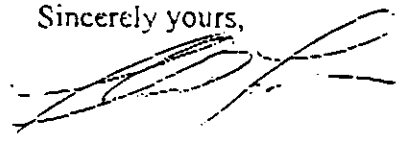
Spacenet welcomes the opportunity to further discuss both immediate enforcement options and long-term solutions to combat harmful interference from Part 15 devices. The need for coordinated action to curtail this known source of harmful interference to licensed VSAT operations is timely and critical.

Sincerely yours,



Theodore D. Frank
Counsel to Spacenet Inc.

cc: Thomas Tycz (by hand delivery)
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SAMPLE 64 KBPS LINK
(DOES NOT INCLUDE INTERFERENCE FOR PART 15 EMISSIONS)
6/12/2001 PH

FROM: MCLEAN, VA TO: CHICAGO, IL

REQUIREMENTS		
Availability	(%):	99.905
*Required Eb/No	(dB):	6.50
*Bit Error Rate	:	10E-7
*Modulation Type	:	QPSK
*Info. Rate	(Kbps):	64.00
*FEC Rate	:	0.50
*Spread Spectrum Factor	:	1.56
*Modem Step Size	(kHz):	10.00

SATELLITE		
*Satellite		GE-4
Satellite West Long	:	101.0
*Transponder		KU
!Usable Trnspndr BW (MHz)	:	36.00
!SFD @ 0 dB/K	(dBW/M^2):	-92.00
*Transponder Atten	(dB):	10.0

TRANSMIT E/S		
North Lat: 38.9	West Long:	77.2
Frequency	(GHz):	14.25
*Satellite G/T	(dB/K):	5.20
*Antenna Diameter	(m):	5.6
Antenna Gain	(dBi):	57.10
Antenna Elevation	(Deg):	38.65
Carrier EIRP	(dBW):	48.99
*Power Control	(dB):	6.00
*Output Circuit Loss	(dB):	4.00
Path Loss	(dB):	207.12
Other Losses	(dB):	0.70
(other loss = atm,pol,ant point)		

RECEIVE E/S		
North Lat: 41.8	West Long:	87.7
Frequency	(GHz):	11.95
*Satellite EIRP	(dBW):	50.00
*Antenna Diameter	(m):	1.2
Antenna Gain	(dBi):	41.70
Antenna Elevation	(Deg):	39.80
*LNA Noise Temp	(K):	58.30
*Loss betw.LNA & Ant.	(dB):	0.20
System Noise Temp.	(K):	100.71
Station G/T	(dB/K):	21.67
Path Loss	(dB):	205.57
Other Losses	(dB):	0.60

INTERFERENCE

C/Io Adj Sat U	(dB-Hz):	71.20	C/Io Intermod	(dB-Hz):	67.07
C/Io Adj Sat D	(dB-Hz):	64.20	C/No Thermal Up	(dB-Hz):	68.97
C/Io Crosspol	(dB-Hz):	76.46	C/No Thermal Dn	(dB-Hz):	63.10
C/Io Adj Channel	(dB-Hz):	78.70	C/Io Total	(dB-Hz):	61.54
C/Io Adj Trans	(dB-Hz):	78.86	C/No Therm Total	(dB-Hz):	62.10
C/Io Microwave	(dB-Hz):	N/A	C/No Total	(dB-Hz):	58.80

RAIN ATTENUATION

Overall Link Margin	(dB):	4.24	*Rain Model	:	CRANE
Uplink Availability	(%):	99.978			
Rain Margin	(dB):	10.24	*Uplink Rain Zone	:	D2
Dnlink Availability	(%):	99.927			
Rain Margin	(dB):	3.32	*Dnlink Rain Zone	:	D2
G/T Degradation	(dB):	4.05			

TRANSPONDER		
*Number of Carriers	:	MULTIPLE
*Total OPBO	(dB):	4.00
Total IBO	(dB):	6.10
*Carrier OPBO	(dB):	31.00
Carrier IBO	(dB):	33.10

H.P.A		
*Number of Carriers	:	1.0
*Total HPA OPBO	:	5.00
HPA Power/Carrier	(dBm):	25.39
Required HPA Size	(dBW):	5.59
Required HPA Size	(W):	3.63

FCC Req: 1) Uplink Flange Density (dBW/4kHz): -22.09 File: FIS_TEST
(@51.0) 2) Downlink EIRP Density (dBW/4kHz): 6.03
Transponder BW Used Per Carrier (x1.00) (%): 0.28 * = default used
(%): 0.20 ! = modif. default